CLAIMS

1. A method of packaging leaky fuel rods (6) for the purpose of transport and long-duration storage or very long-duration warehousing, each leaky fuel rod (or defective rod) (6) containing pellets of fuel material in tubular cladding (6a) closed at its ends and presenting a sealing defect, and the leaky fuel rods being deposited in a first step underwater in a pool, the method being characterized by:

· making available a plurality of capsules, each for receiving a single fuel rod and comprising a tubular sheath (8a) and two end plugs (9, 14), at least one of which is removable;

· placing a loading structure (20) in the pool, in a disposition enabling it to receive at least one capsule of the plurality of capsules (8) with its axis vertical;

· securing on an open top end of the loading structure (20) a device (32) for loading a fuel rod (6) into the capsule (8);

· taking the leaky rods one by one from intermediate storage means in which the leaky rods coming from at least one fuel assembly have been placed, and inserting them one by one into empty capsules in the loading structure (20), the capsules being in a vertical position in a loading location (27a) vertically beneath an opening (34a) of the loading device (32), and then for each of the capsules (8) that is to receive a defective rod (6):

· unscrewing a plug (14) of the capsule (8) situated at its top end, inserting a defective rod (6) into the capsule via a guide device (29) placed at the opening (34a) of the loading device (32), and screwing the top plug (14) of the capsule (8) back into place; and

· placing the capsule (8) containing the defective rod in a location of a support structure (20); and

· transporting and storing defective rods (6) inside capsules (8) placed in the support structure (20).

2. A method according to claim 1, characterized by the fact that the loading structure comprises a frame for receiving the capsules (8), the frame comprising a handling top nozzle (21a) and a bottom nozzle (21b) both extending transversely, the nozzles being assembled to each other by longitudinally-extending tie-bars (23), together with a plurality of transversely-extending spacer plates (25) distributed in the longitudinal direction of the loading structure (20) and each comprising an array of openings, each serving to pass and hold a respective capsule (8), some having engaged therein the assembly tie-bars (23) of the frame of the loading structure (20), the structure (20) including a first location (27a) for loading capsules in the vicinity of a corner of the cross-sections of the square-shaped loading structure.

3. A method according to claim 2, characterized by the fact that the loading structure further comprises a second location (27b) in which the bottom nozzle (21b) of the loading structure includes an opening (29) for receiving a closure plug at the bottom end of a capsule, said location having placed therein a peg (31) projecting into the loading structure, by the fact that the bottom and top plugs (9, 14) of the capsules (8) are pierced axially by respective channels having respective channel-closure valves (10, 17) located therein and urged towards a closed position by respective helical springs (11, 18), the open end of the channel (16) in the top plug (14) including means for connection to a duct (15b) for feeding inert gas, and by the fact that after a faulty rod has been inserted in a capsule (8) and the top plug (14) has been screwed back onto the capsule (8) in the loading first location (27a), the capsule (8) is transferred to the second location (27b) for filling with inert gas, the bottom plug (9) of the capsule is inserted

into the corresponding housing (29) of the bottom nozzle (21b), so that the projecting peg (31) lifts the valve (10) of the bottom plug (9) into the open position, and an inert gas under pressure, such as argon, is delivered into the inlet end portion (16a) of the channel (16) in the top plug (14), so as to open the valve (17) of the top plug (14) and then fill the inside space of the capsule (8) with inert gas, the water and the gas contained in the capsule (8) being expelled through the channel (9a) in the bottom plug (9), the delivery of inert gas being stopped after the inside space of the capsule (8) has been filled, so that the closure valve (17) of the top plug (14) recloses, with the defective rod (6) then being stored inside the capsule (8) in an atmosphere of inert gas under pressure.

4. A method according to claim 2 or claim 3, characterized by the fact that the support structure (20) for the capsules (8) in which capsules (8) containing defective rods are transported and stored over long duration is constituted by the loading structure (20) itself.

5. A method according to claim 1, characterized by the fact that the support structure (20) for capsules (8) containing defective fuel rods is constituted by a transport and/or storage container including at least one location for receiving at least one of a loading structure (20) and a capsule (8).

6. A method according to claim 1, characterized by the fact that the support structure (20) constitutes warehousing means containing at least one case having substantially the shape and the dimensions of a fuel assembly for receiving a plurality of capsules (8) and closable by sealed covers.

7. A method according to claim 6, characterized by the fact that a sealed barrier is constituted around each of the defective rods by at least one of the capsules (8) containing the rod and a case containing the capsule (8).

8. A method according to claim 6, characterized by the fact that the warehousing means is designed to receive at least one loading structure (20) in the place of a case.

9. A packaging device for implementing a method according to claim 1, the device being characterized by the fact that it comprises:

· a loading structure (20) for loading defective rods (6) into capsules (8), the structure having a loading location (27a) for loading each capsule (8) with a defective rod, and a filling location (27b) for filling each capsule (8) with an inert gas;

· a guide and holder device (32) having positioning means (3) for positioning it on the loading structure (20);

· a support structure (20) for supporting capsules (8) for long-duration storage or for very long-duration warehousing; and

· a tool (15) for handling and filling the capsules (8).

10. A device according to claim 9 for implementing the method of claim 3, the device being characterized by the facts that:

· the loading structure (20) presents the shape and the dimensions of a fuel assembly (1) and comprises a top nozzle (21a) and a bottom nozzle (21b) assembled together by tie-bars (23) extending in a longitudinal direction relative to the nozzles (21a, 21b) that extend in a transverse direction, a plurality of spacer plates (25) in transverse dispositions distributed along the longitudinal direction of the loading structure (20) and

a peg (31) for actuating a valve (10) disposed in a channel (9a, 9b) passing through a bottom plug (9) in each capsule (8), the peg being located in the filling location (27b);

· the loading device (32) comprises a centering plate (32a) provided with means (33) for positioning it on the loading structure (20), first and second openings (34a, 34b) passing through the centering plate (32a), and clamping means (35, 36) for clamping a capsule (8) inserted in the loading structure (20) in the loading location (27a), together with a guide bell (39) suitable for being placed on the centering plate (32a) at the first opening (34a); and

· the tool (15) for handling and filling capsules (8) comprising an outer tube (15a) shaped to be engaged on a shaped top plug (14) of a capsule (8) so as to be constrained to turn together with the top plug (14) that can be screwed to and unscrewed from a body (8a) of the capsule (8), and an inner tube (15b) for feeding gas that is suitable for connection to a channel (14b, 14c) passing through the top plug (14) of each capsule (8).

11. A device according to claim 9, characterized by the fact that the loading structure (20) has a plurality of storage locations for capsules (8) and constitutes the support structure for capsules (8).